Bay County Mosquito Control

2012 Annual Report

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Cover: Technician Katlyn Smrecak works the early spring season monitoring larval development in a woodland pool

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History of Organization

Bay County Mosquito Control (BCMC) began operations within the organizational structure of the Bay County Health Department and under the auspices of the Bay County Executive in January of 1985. The program began in 1977 as part of the bi-county district, Saginaw-Bay Mosquito Control Commission.

Mosquito "control" does not mean elimination, but involves Integrated Pest Management (IPM) methods designed to reduce the number of mosquitoes so they no longer unfavorably affect the health and quality of life of Bay County residents. BCMC provides a variety of services to the 109,000 residents living in an area covering 444 square miles.

As one of the divisions of the Environmental Affairs and Community Development Department, we acknowledge the importance of serving the public by providing services without producing adverse impacts on the environment. The program consists of field operations, biological surveillance, disease surveillance, and education.

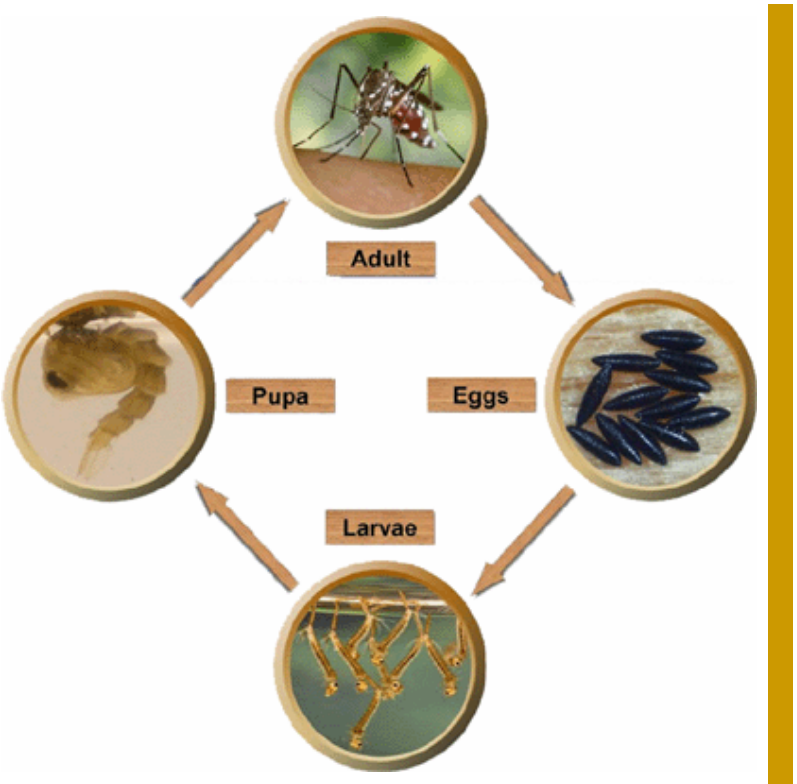
Bay County is one of four Michigan counties with formal, comprehensive mosquito control programs. A Technical Advisory Committee (TAC), composed of local and state professionals, reviews program operations each March.

Funding is received from a special millage for the control and abatement of mosquitoes and the diseases borne by mosquitoes. The current 0.45 mill tax levy was renewed on August 5, 2008 for an additional eight years in Bay County with an overwhelming approval rating of 84%. This millage rate has been in place since 1988.

Mosquito Biology and Life Cycle

Mosquitoes are aquatic insects that undergo a complete metamorphosis involving four distinct stages—egg, larva, pupa, adult—throughout their life cycles. Female mosquitoes can develop several hundred eggs with each blood meal and lay them in or around water. The eggs are laid (where standing water accumulates after rain or flooding) either singly or attached to one another to form an egg raft that floats on the water's surface. Once eggs hatch, larvae emerge, wriggling through the water. The larvae are filter feeders that eat voraciously and outgrow their skin. Larvae undergo four stages or instars before they change into pupae, which happens about one week after the eggs initially hatch. Pupae do not feed and are often found at the surface of water (like larvae) so they can breathe. Inside the pupa's protective shell, the mosquito transforms into the winged adult. Eclosion is the emergence of the adult mosquito from the pupal case. These newly-emerged adults use the cast skin for support until their wings and body dry, at which time they fly away. The whole life cycle is typically a quick process, taking about a week to complete. The time required to complete the life cycle is dependent on temperature—the warmer the water, the more quickly a mosquito develops.

After mating, females seek out an animal upon which to feed and this blood provides protein to develop eggs. Males do not bite, but do have sucking mouthparts to obtain plant nectar as a source of energy; females do this as well. Next, females search for an aquatic habitat or moist ground to deposit eggs. Although there are exceptions to the rule, most adult mosquitoes live for a period of four to eight weeks.



Spring Larval Surveillance

As a result of spring flooding due to rainfall or snowmelt, the potential exists each year for significant spring mosquito larval development in the woodland areas of Bay County. Spring aerial treatment utilizing one helicopter and two fixed wing aircraft is conducted when larvae reach the second or third instar growth stage. Monitoring larval development is critical in order to have a timely application of *Bti* (*Bacillus thuringiensis israelensis*), a bacterium eaten by larvae that causes mortality within 48 hours. The *Bti* may be used as a food source by other aquatic organisms that occupy the same woodland pool habitats.

Surveillance is an essential part of the spring mosquito control program. Mosquito larval surveillance usually begins in late March, but this year first instars were observed in woodland pools on March 7th, which is quite early. A week later on March 13 larvae were still first instars, but a string of eight days with temperatures averaging 30 degrees above normal (60-80° F from March 13-20), had larvae growing quickly. These ideal larval developing conditions forced an early spring treatment, beginning on March 25, which is the earliest start date in BCMC's history!

Woodlots were wet at the onset—basically an average year—but conditions saw pools decreasing in size, and, in some cases, disappearing altogether. Rainfall in March totaled 1.78", which is six-tenths of an inch below the historical average; the trend continued in April with only 0.5" recorded, which is over 2" below normal. Monitoring continued after small rain events and indicated a few sites had an early hatch of *Aedes vexans* in woodland pool habitats. Pretreatment larval counts were taken between 1-4 days before treatment in 37 woodlots and post counts followed within 5-8 days of treatment.

Field technician, Robert Klenk, checks a flooded woodlot for mosquito larval activity

Aerial calibration took place unseasonably early on March 25 with treatment beginning immediately and lasting 8 days until April 2nd. Fixed wing aircraft were calibrated to deliver 4 pounds of *Bti* per acre while the helicopter was calibrated for 5 pounds per acre.

Quality control of the spring aerial campaign was accomplished by four certified technicians who walked through 75 treated woodlots over the course of the program in order to determine both the average number of *Bti* granules per square foot, which helped confirm the dosage rate and locate possible skips or misses occurring with the aerial application (see photo below).

Post counts indicated an overall average 93.8% larval mortality (Table 1). Favorable control was seen at both the 4-pound and 5-pound per acre dosage; results were not significantly different. Most woodlots had excellent *Bti* coverage and, as usual, where there was *Bti*, there were either no mosquito larvae found or only dead larvae floating throughout the water column. Frogs, tadpoles, seed shrimp, fairy shrimp, water fleas, copepods, and caddisflies that were observed in the woodland water habitats before treatment were found in large numbers after treatment, as well.

Adult emergence of spring *Aedes* and *Aedes vexans* mosquitoes from seasonally flooded woodlots took place from approximately April 18-25, a full three weeks in advance of the historical average. Cool temperatures during this time kept complaint calls down. Early May trapping indicated very little spring adult mosquito activity. After the majority of adults emerged, there were four evenings from April 26-30 that had either freezing temperatures or, at least, frosty mornings. This may have led to a reduction in the spring adult population.

Field technician, Jim Hughes, checks for the presence of *Bti* in a woodlot after aerial treatment

Table 1

Bay County Mosquito Control Spring Treatment 2012 - Bti Evaluation

		Larval Count		
Location	**Applicator**	**Pre**	**Post**	**Mortality**
Bangor 4 - Bangor Oil Well	Helicopter	1.04	0.08	92%
Bangor 31 - St. Maria Goretti Church	Helicopter	0.44	0	100%
Bangor 33 - Bangor and Zimmer	Helicopter	1.48	0.43	70.9%
Beaver 4 - 1576 Cottage Grove	Fixed Wing	1.5	0.08	94.7%
Beaver 5 - Carter and Cottage Grove	Fixed Wing	0.66	0	100%
Beaver 9 - 1585 Cottage Grove	Fixed Wing	1.96	0	100%
Frankenlust 2 - Four Mile and Delta	Helicopter	2.52	0.04	98.4%
Frankenlust 3 - Delta by Automotive Bldg.	Helicopter	1.56	0.02	98.7%
Frankenlust 7 - 259 Amelith Road	Helicopter	2.04	0.04	98%
Fraser 6 - Townline 16 by 7 Mile Rd.	Fixed Wing	1.32	0.12	90.9%
Fraser 11 - Camp Fishtales	Fixed Wing	0.75	0	100%
Fraser 15 - Fraser Twp. Firebarn	Fixed Wing	2.34	0	100%
Fraser 22 - Fraser Twp. Hall	Fixed Wing	1.11	0.02	98.2%
Garfield 9 - 11 Mile N. of Erickson	Fixed Wing	0.98	0	100%
Garfield 10 - Garfield Twp. Park	Fixed Wing	1.3	0.06	95.4%
Garfield 15 - Methodist Church	Fixed Wing	0.76	0	100%
Garfield 26 - Crump Fox Club	Fixed Wing	1.46	0	100%
Kawkawlin 2 - 2080 LeBourdais Rd.	Fixed Wing	1.4	0.02	98.6%
Kawkawlin 30 - White Birch Village	Fixed Wing	0.82	0	100%
Monitor 9 - 1306 Wheeler	Helicopter	1.3	0.28	78.5%
Monitor 20 - Fraser and N. Union	Helicopter	1.48	0.02	98.6%
Monitor 23 - Rocking Horse Ranch	Helicopter	0.84	0.1	88.1%
Monitor 28 - Mackinaw Road Tech Park	Helicopter	1.96	0	100%
Monitor 34 - Fremont Cemetery	Helicopter	0.84	0	100%
Mt. Forest 17 - Carter N. of Cody-Estey	Fixed Wing	1.94	0.2	89.7%
Mt. Forest 20 - McKinnons on Flajole	Fixed Wing	1.3	0	100%
Mt. Forest 21 - Mt. Forest School	Fixed Wing	1.58	0.38	75.9%
Mt. Forest 21 - Mt. Forest Firebarn	Fixed Wing	2.42	0.54	77.7%
Mt. Forest 30 - Pinconning and County Line	Fixed Wing	2.66	0.44	83.5%
Pinconning 23 - K C Hall Water Street	Fixed Wing	1.82	0.14	92.3%
Pinconning 30E - Pinconning County Park	Fixed Wing	0.7	0.02	97.1%
Williams 16 - Carter and N. Union	Fixed Wing	0.68	0.14	79.4%
Williams 19 - Victoria Woods Trailer Park	Fixed Wing	1.15	0.05	95.7%
Williams 20 - Forest School/Daycare	Fixed Wing	1.42	0.1	93%
Williams 21 - Forest Edge	Fixed Wing	0.9	0	100%
Williams 30 - Rockwell and Salzburg	Fixed Wing	0.74	0	100%
Frankenlust 2 - Four Mile and Delta	**Control**	2.52	2.96	0%
Frankenlust 3 - Delta Mackinaw Road	**Control**	0.8	0.78	2.5%
Mt. Forest 30 - Pinconning and County Line	**Control**	2.66	2.5	6%
AVERAGE TREATED MORTALITY				**94%**
AVERAGE TREATED MORTALITY (Corrected)				**93.8%**
AVERAGE 4#/ACRE DOSAGE				**94.5%**
AVERAGE 5#/ACRE DOSAGE				**93%**

Summer Larval Surveillance

Surveillance is the key component of an Integrated Pest Management (IPM) program and there are two main types — larval and adult — that are completed to monitor mosquitoes county-wide to determine distribution, density, and species composition. Surveillance is a combined effort conducted by larviciding crews, field supervisors, and biology personnel.

Staff conducted routine surveillance of probable mosquito breeding sites using a standard pint-sized dipper. Stagnant water sites included ditches, catch basins, flooded fields, woodlots, and tires. Roadside ditch larval site inspections, termed sequential sampling, occurred weekly throughout the county with larval samples collected and identified to determine the need for control. Three hundred eight larval samples representing fifteen species were identified; the majority were *Aedes vexans* followed by *Culex pipiens* and *Culex restuans*. Twenty-six larval samples were identified as *Aedes japonicus,* the newest mosquito species to Bay County, which was found breeding primarily in tires and containers. The 2012 season brought the first larval *Uranotaenia sapphirina*, which was found breeding in a flooded woodlot in Kawkawlin Township on June 26. Adults of this species are found each year in low numbers as summer fades to fall, but this was the first larval sample collected.

To assess the activity of *Culex* mosquitoes in city and suburban catch basins, biology staff randomly inspected 40-50 basins on six occasions. The basins are a perfect habitat, providing *Culex* mosquitoes with organically-rich standing water and decomposing leaf litter, which provides a bacterial food source. A few egg rafts were found as early as May 2, but more widespread larval activity wasn't noted until June 14. This prompted the initial treatment using VectoLex CG and Natular XRT. In order to determine efficacy and longevity of the control materials, basins were inspected every three weeks. VectoLex provided control through four weeks-post-treatment, which prompted re-treatment while Natular-treated basins were hand-treated once this season.

Quality control continued to be an essential function for biology technicians. Habitats that were recently treated were re-checked to ensure control materials were properly applied and effective. Quality control efforts began with surveys of woodlots in April to assure proper treatment. Container, roadside ditch, floodplain, and catch basin surveys continued as the summer wore on.

Aedes japonicus is a container-breeding mosquito species native to Asian countries. It was first discovered in Bay County in 2005 in its adult form, but began to crop up in larval samples in 2006. The following two figures show how this invasive species has begun to occupy several habitats including artificial containers (Figure 1) and tires (Figure 2) through the years. Technicians have also sampled *Ae. japonicus* larvae to a lesser extent in ornamental ponds, cross country drains, tree holes, roadside ditches, and ponds.

Figure 1

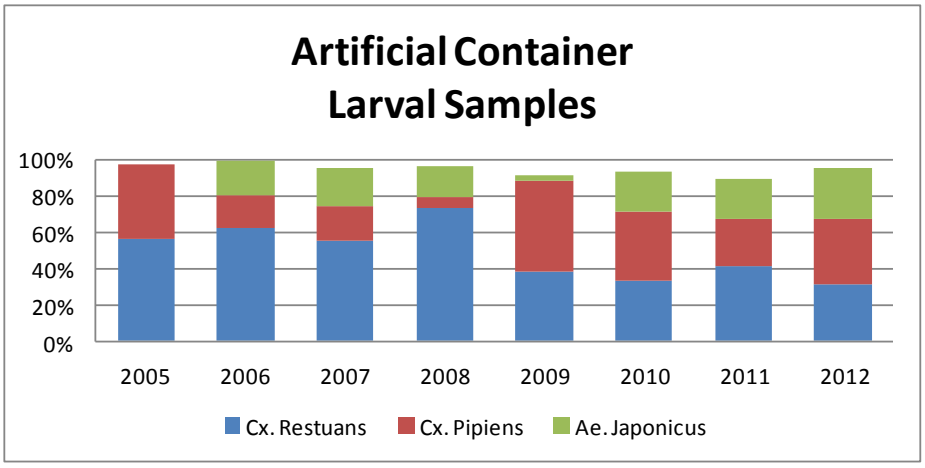
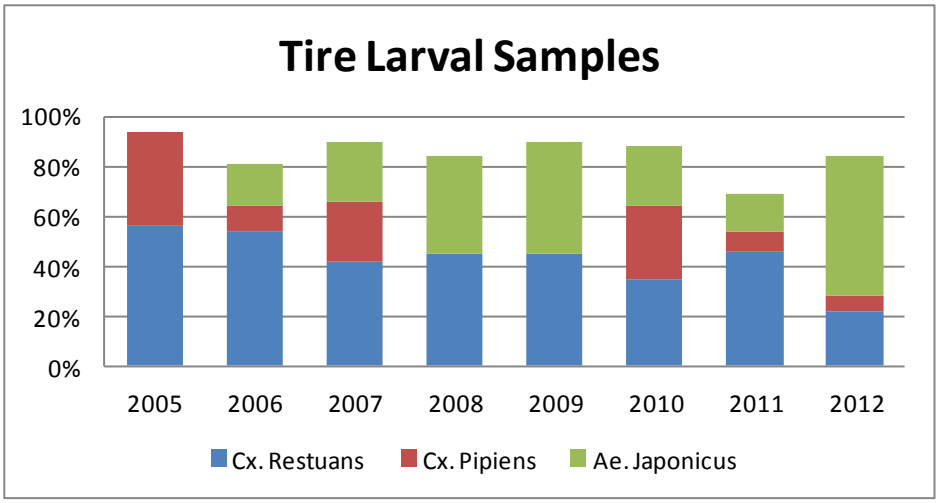


Figure 2



New Jersey Light Traps

As in previous years, Bay County Mosquito Control completed regular mosquito trapping throughout the season. Trapping data is critical to the mosquito management program as it helps recognize mosquito numbers, species, location, and potential disease threat. One of the main tools used in adult surveillance is the NJLT.

From mid-May through mid-September, adult mosquitoes were collected in 14 traps placed throughout the county. The traps were placed in backyards where there was little or no competing light source. Samples were gathered three times each week, followed by counting and species identification. The total capture was 7,294 (Table 2), much below both the 2011 season (47%) and the historical average of 15,025. The hot, dry summer led to few *Aedes vexans* (except for late August following heavy rains); in fact all species were collected in fewer numbers than most years.

Lab technician, Emily Bladecki, identifies adult mosquitoes

Table 2

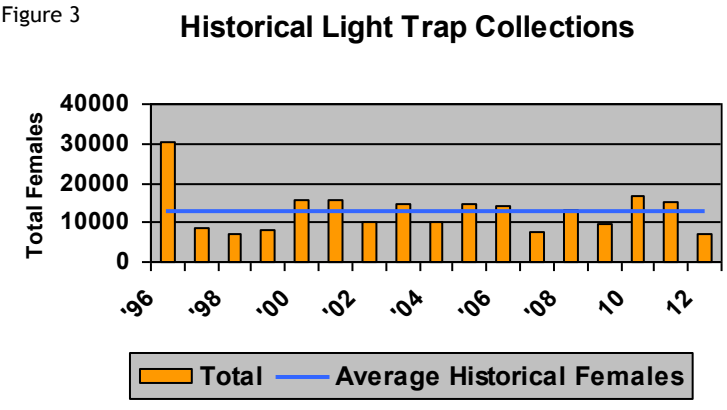
Species	May	Jun	Jul	Aug	Sep	TOTAL
Ae. vexans	48	580	280	3638	337	4883
Ae. intrudens	0	0	0	0	0	0
Ae. implicatus	0	0	0	0	0	0
Ae. stim/fitchii	2	9	8	0	0	19
Ae. canadensis	0	1	0	0	0	1
Ae. triseriatus	0	0	0	1	1	2
Ae. trivittatus	1	15	3	42	6	67
Ae. sticticus	0	0	0	2	0	2
Ae. japonicus	0	0	2	3	1	6
An. punctipennis	3	26	79	49	3	160
An. quadrimaculatus	24	125	213	218	32	612
An. walkeri	2	2	2	6	6	18
An. perplexens	0	0	0	1	2	3
Cs. inornata	19	1	1	0	2	23
Cs. morsitans	0	0	0	0	0	0
Cq. perturbans	0	312	434	8	0	754
Cx. pipiens	0	42	133	342	99	616
Cx. restuans	15	17	5	17	0	54
Cx. territans	0	5	8	15	2	30
Ps.ciliata	0	0	1	5	0	6
Ps.ferox	0	0	0	6	1	7
Ur. sapphirina	0	0	2	21	1	24
Damaged	1	6	0	0	0	7
Male Mosquitoes	55	636	373	4556	312	5932
Total Females	115	1141	1171	4374	493	7294

Nineteen species were collected during the 2012 season and the most predominant was *Aedes vexans*, representing 67% of the total. It is not unusual for *Ae. vexans* to rank first because it is the floodwater mosquito and hatches after heavy rains flood ditches, fields, and woodlots. The *Anopheles* species (*quadrimaculatus*, *walkeri*, *punctipennis*, and *perplexens*) represented 11% of the total catch, while the cattail marsh mosquito, *Coquillettidia perturbans* ranked third with 10%. Emergence of *Cq. perturbans* adults occurred as normal, but the population dropped off about a week earlier than usual although its numbers were higher than the historical average of 7.6%. Finally, we watched, with great interest, our newest mosquito species, *Aedes japonicus,* whose numbers remained virtually unchanged since 2008 with six captured. The average number of *japonicus* collected since 2005, the first year they were discovered, is 11. The number of larvae collected, however, indicates more adults must be present. We may not yet have found the best trapping mechanism for this particular species.

Figure 3 shows a historical perspective of light trap collections with the average number collected in a given year represented by the solid blue line (12,891). As you can see, the number collected in 2012 was about half as many as the average. Typically, total number of females corresponds with the amount of rainfall received and this year our heaviest rains came in August when 7-9" of rain fell between August 8-10 Prior to this rain event, the county experienced drought-like conditions. Little rain fell in September so we ended the year without much fanfare.

Figure 4 (page 14) shows mosquito species collected per trap night throughout the summer. Summer floodwater *Aedes* had a small peak on June 21, but saw a spike in numbers during the last week of August. This spike followed the major rain event by two weeks. Figure 5 (page 15) shows the adult mosquito abundance trend for Bay County's most active species, *Ae. vexans*. You can clearly see the major peak in activity at the end of August.

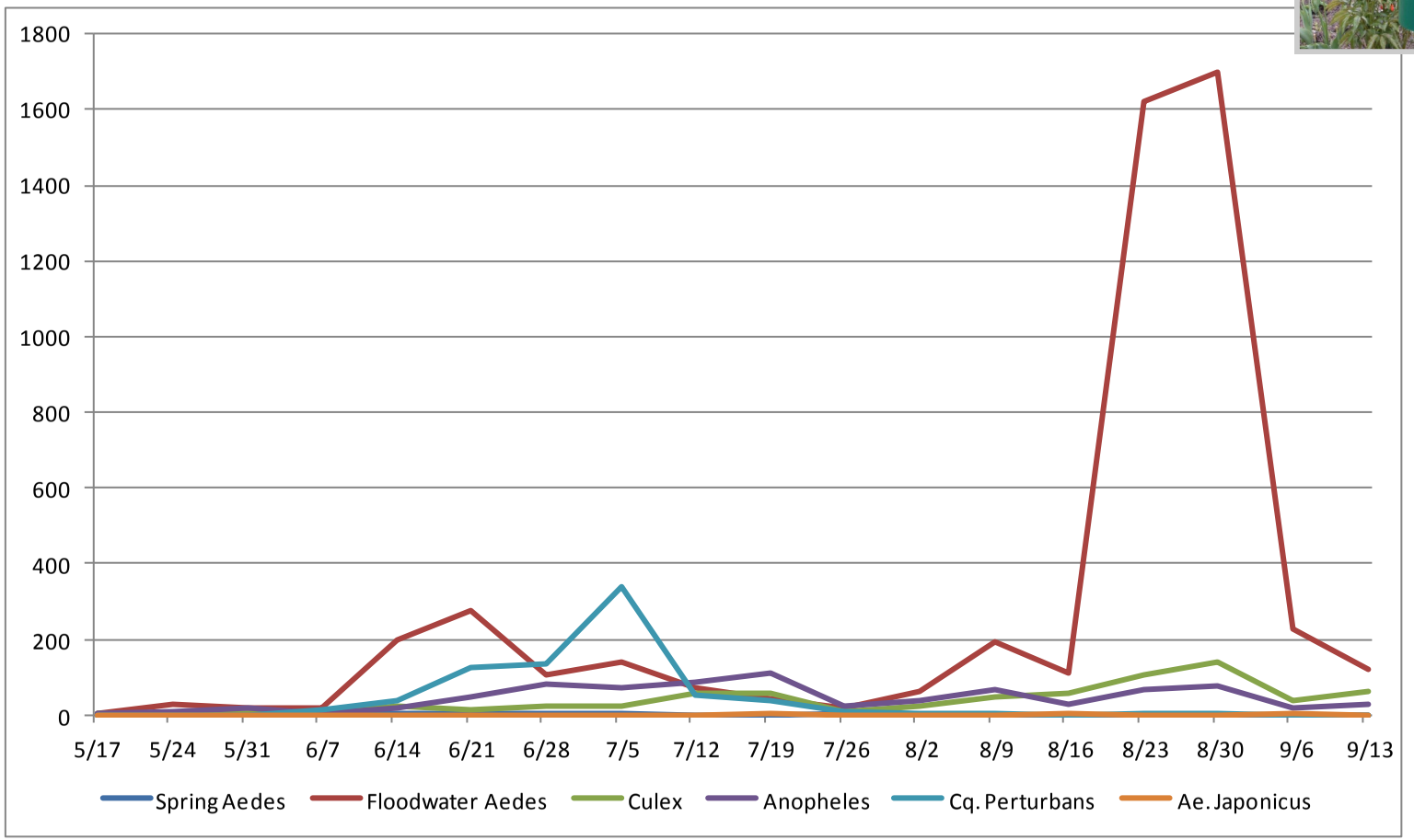
Figure 3



New Jersey Light Traps 2012

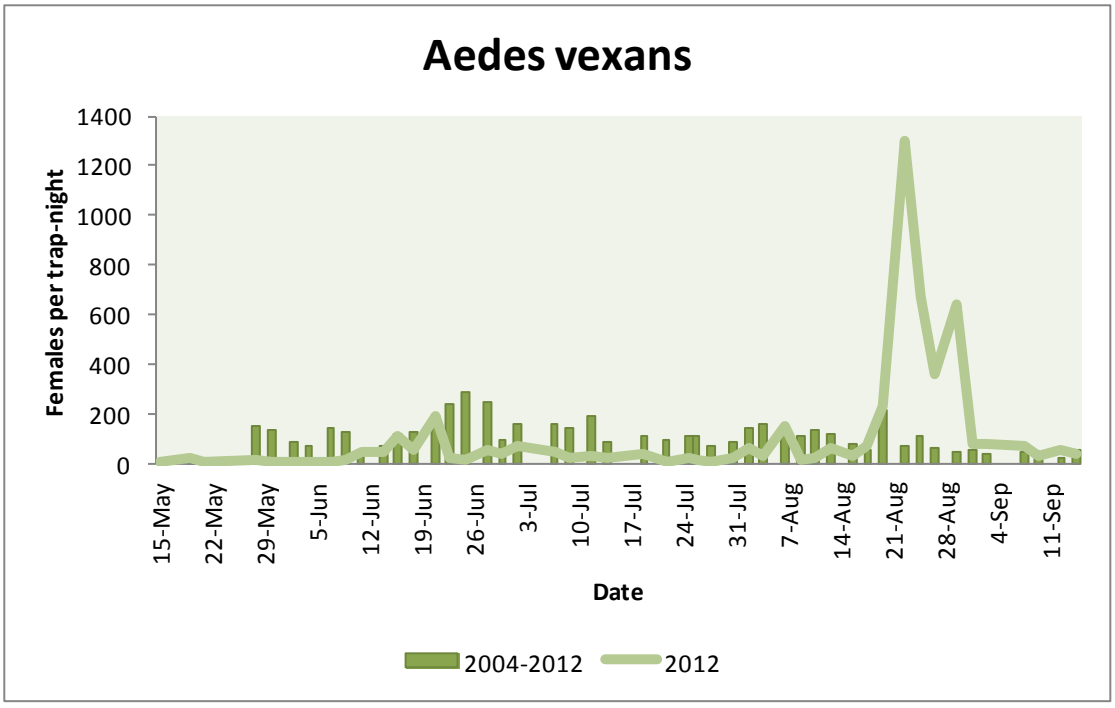
Weekly Captures

Figure 4



New Jersey Light Traps 2012
Adult Mosquito Abundance Trends

Figure 5



The species shown here, *Ae. vexans*, is considered the most significant in Bay County and is widespread and abundant. Its larvae are found in temporary rain-filled fields, woodlots, or ditches with several generations emerging each summer. Adults are bothersome daytime and evening biters and have a long flight range—over five miles.

By early August, the 2012 season was stacking up to be one of the slowest on record, regarding numbers of adult mosquitoes. However, a major hatch in late August that corresponded to heavy rains, saw the counts rebounding. Rain gauges in Bangor and Monitor Townships were completely full indicating at least six inches of rain recorded in one rain event. The actual amount was closer to seven or eight inches.

The spike in adult mosquitoes triggered numerous phone calls from Bay County residents with hundreds of phone calls logged the last week of August and first week of September.

CDC Traps

CDC Traps are another mechanical trap utilized in Bay County Mosquito Control's adult surveillance program. The CDC Trap attracts blood-seeking female mosquitoes with the use of dry ice (carbon dioxide) as bait. Traps are placed overnight within woodlots, summer festival grounds, treatment sites, and personal residences. Usually the traps hold diverse species and larger mosquito numbers compared to New Jersey Light Traps. Traps are also used to assess homeowner complaints, gather arbovirus information, and record changes in abundance of mosquitoes before and after control operations.

These traps are quite good at sampling most of the district's 20+ individual mosquito species, each one being a little different from the other due to where they prefer to breed, their biting habits, flight range, and ability to transmit disease.

The total number of mosquitoes captured in CDC traps this year was 31,315 (Table 3—page 17). *Aedes vexans* and *Ae. trivittatus* remained at the top ranking spot, representing 78% of the total with *Culex* species numbers up from 2011, most likely due to a mild winter which allowed over-wintering *Culex* adults to fare better than other years. Almost 18,000 adults (57% of total catch) were collected in traps after August 23. Prior to the end of August, adults captured in traps numbered half as many as an average year.

Spring of 2012 was one of the strangest on record with an early warm-up followed by frosts and freezes wreaking havoc on crops statewide. Interestingly, there was an almost virtual absence of spring *Aedes* mosquitoes. Spring mosquitoes that emerged early due to record-warmth in March, were hit hard by frosts at the end of April. Few adults were sampled in either CDC or Light Traps.

Sixteen species in five genera were collected and identified, averaging 103 females per trap, up slightly compared to 93 in 2011. The average number of females in 2010 and 2009 was 102 and 97, respectively. This year we continued to trap twice weekly, placing 20 traps total each week. Some traps sampled the same locations while others were placed based on dead bird reports, mosquito complaints, or other indicators of possible virus or nuisance risk.

Mosquitoes from CDC Traps, like New Jersey Light Traps, were tested for mosquito-borne viruses in batches of between 5-50 individuals of a particular species sampled from the same location. There were four West Nile Virus-positive pools of *Culex* mosquitoes collected from CDC Traps placed in Pinconning Township, Hampton Township, and Bangor Township (2).

CDC Traps

Table 3

Species	May	Jun	Jul	Aug	Sep	TOTAL
Aedes vexans	17	3888	1742	8554	2905	17106
Aedes cinereus	0	0	0	0	0	0
Aedes intrudens	0	0	0	0	0	0
Aedes implicatus	0	0	0	0	0	0
Aedes stimulans/fitchii	13	68	65	4	0	150
Aedes Canadensis	52	11	0	0	0	63
Aedes sticticus	0	15	0	1	162	178
Aedes triseriatus	0	1	1	7	15	24
Aedes trivittatus	13	1508	256	3908	1747	7432
Aedes japonicus	0	0	2	0	0	2
Anopheles punctipennis	4	14	102	18	1	139
Anopheles quadrimaculatus	0	126	139	53	16	334
Anopheles walker	0	218	0	16	10	244
Anopheles perplexens	0	0	0	0	1	1
Culiseta inornata	0	0	0	0	0	0
Coquillettidia perturbans	0	1969	699	55	0	2723
Culex pipiens	0	30	577	885	221	1713
Culex restuans	2	30	12	1	0	45
Culex territans	0	1	1	3	0	5
Psorophora ferox	0	7	10	339	758	1114
Psorophora ciliata	0	0	0	0	0	0
Uranotaenia sapphirina	0	0	0	0	0	0
Damaged/Others	4	37	1	0	0	42
Total Females	105	7923	3607	13844	5836	31315

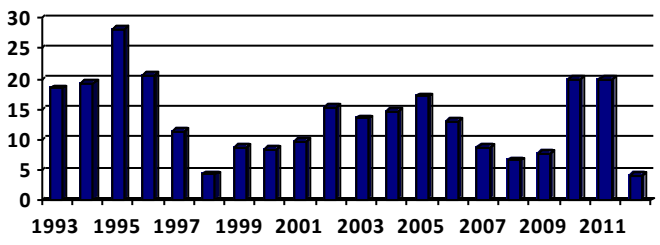
Gravid Traps

Gravid traps offer another method to collect female mosquitoes, primarily *Culex* species that have taken a blood meal and are searching for a suitable place to lay eggs (oviposit). This trap is selective for blood-fed female *Culex* mosquitoes; therefore, the traps provide a good means for early West Nile Virus (WNV) detection.

A solution containing water, brewer's yeast, whey, and guinea pig pellets is allowed to ferment for about a week before being poured into a plastic tub, over top of which sits the gravid trap. This organically-rich water is the attractant to gravid (egg-bearing) females.

Gravid trap placement ran from June through September with 180 traps capturing 916 mosquitoes (745 *Culex* species, 9 *Ae. japonicus*, 12 *Ae. vexans*, 26 *Anopheles* species, 1 *Ae. triseriatus*, 1 *Cq. perturbans*, 1 *Ae. trivittatus*, 1 damaged female and 120 males). Traps were placed in a variety of locations, including the immediate area of WNV activity. *Culex* mosquitoes collected in gravid traps were grouped together and submitted to Michigan State University (MSU) for WNV-detection. Figure 6 shows a historical perspective of the average number of *Culex* mosquitoes collected per gravid trap. Collections from 2012 number far less than the past two years, with an average of four female *Culex* mosquitoes per trap.

Figure 6



North American Mosquito Collection Project

Bay County Mosquito Control volunteered in a study conducted by the United States Department of Agriculture's Agricultural Research Service (ARS) looking at the population structure of *Aedes vexans* mosquitoes. The ARS is interested in *Ae. vexans* because they are a competent vector for many viruses including West Nile, Rift Valley Fever, and St. Louis encephalitis and since they feed on both mammals and birds, they potentially serve as a bridge vector for these pathogens.

The goal of the study is to collect disease vectors from at least 175 sites throughout their known distribution in North America for a large population genetics study. Forty-four samples were submitted to the ARS lab in Manhattan, Kansas, which contained a total of 5,492 individual females.

The study runs through August 31, 2014, so we anticipate continuing submissions for the next two seasons.

Disease Surveillance

Since the inception of Bay County Mosquito Control, efforts have been targeted at controlling known disease vectors as well as nuisance mosquito species. While reducing annoyance and improving quality of life are important, the primary goal of our program has always been to reduce mosquito numbers in order to decrease the risk of diseases transmitted by them. Since WNV came on the scene in 2001, our efforts at disease prevention and public education have taken on a bigger role.

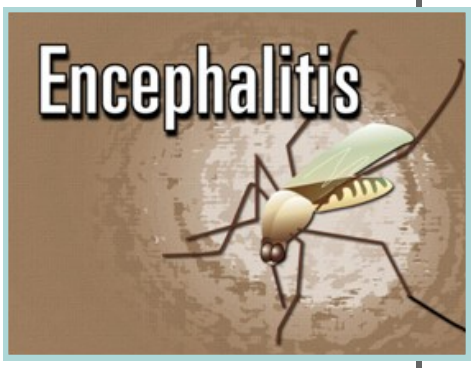
St. Louis encephalitis, Eastern Equine encephalitis, LaCrosse encephalitis, West Nile virus, and dog heartworm are all mosquito-borne pathogens found in Michigan. Mosquito pools are submitted to MSU's Microbiology and Molecular Genetics Department to be analyzed for these disease agents.

A mosquito pool is a group of up to 50 mosquitoes of the same species collected from a trap, placed in a vial, and tested for mosquito-borne disease. Two hundred eighty-three pools containing 5,495 females representing a variety of species were tested with the following results:

- *Coquillettidia perturbans* (144 pools/2,944 females/no positives)
- *Culex restuans/pipiens* (138 pools/2,546 females/**6 positives**)
- *Aedes japonicus* (1 pool/5 females/no positives)

A positive pool indicates local mosquitoes are infected with West Nile Virus and are capable of transmitting it to humans and other hosts. Four of the positive pools were collected from CDC traps placed in the following places: Bangor Township's Water Treatment Plant (7/25/12; 50 *Culex*), Bangor Township on State Park Drive (8/17/12; 46 *Culex*), Pinconning Township's Conservation Club (8/1/12; 43 *Culex*), and Hampton Township's Finn Road Park (9/6/12; 33 *Culex*). The other two positive pools were from New Jersey Light Traps—Auburn at 204 Grant Street (8/22/12; 27 *Culex*) and Bay City at 1600 S. Grant Street (8/22/12; 12 *Culex*). In 2011 eight pools tested positive, but seven of the eight pools were from the same location and trap night.

Mosquito surveillance data are useful in tracking virus activity. The minimum infection rate (MIR) is a calculation of the number of infected mosquitoes per 1,000 of a particular species. The higher the MIR, the higher the level of viral activity and the greater the chance for human infections. A MIR of 4 or above indicates a high level of viral activity. The MIR for *Culex* mosquitoes at BCMC in 2012 was 2.3; for *Coquillettidia perturbans* the MIR was 0.



The dead bird surveillance program was established in 2001 by the Michigan Department of Community Health in collaboration with local agencies. We rely on Bay County citizens reporting dead birds as one method of WNV surveillance. The number of phone calls reporting dead birds throughout the community skyrocketed this year compared to the past few. Only 18 calls were received last year, but that number climbed to 95 this year. This number more closely compares with 2008 when 100 calls were received. In 2012, 106 dead birds were reported, most of which were American Crows (52), Blue Jays (24), House Sparrows (11), Common Grackles/ European Starlings/other blackbirds (14). All dead bird sightings were logged onto Michigan's Emerging Diseases website www.michigan.gov/emergingdiseases. After initial screening by staff, a total of 44 crows or jays were tested with 6 **testing positive**—a crow from Hampton Twp. (8/21), a crow from Frankenlust Twp. (8/31), a crow from Bay City West (9/3), a blue jay from Bangor Twp. (9/4), a crow from Kawkawlin Twp. (9/5), and a crow from Bay City East (9/24). Using the WNV VecTest® kit or the Vector Test™, American Crows and Blue Jays were tested to determine infection rates. Samples were confirmed positive by MSU's Diagnostic Center for Population and Animal Health. Compared to 2007-2011, disease activity showed a strong rebound for Bay County.

Statewide, there were 229 human cases reported through November 20, 2012 (Table 4) with 14 fatalities occurring mostly in the greater Detroit and Grand Rapids communities. This is the second largest Michigan outbreak to date.

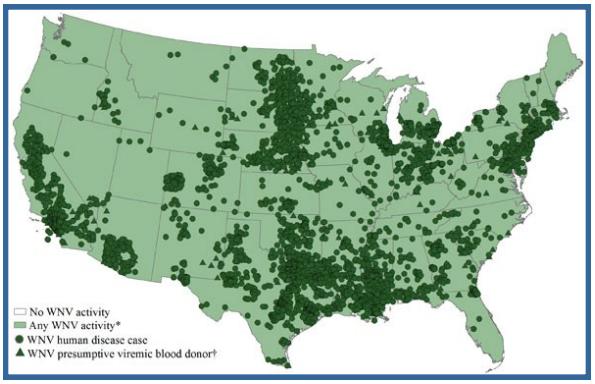
Nationally, there were 5,245 human WNV cases with 236 deaths, as of November 27. This is the highest number of WNV disease cases reported to CDC through the fourth week in November since 2003. Eighty percent of the cases were reported from 13 states (Texas, California, Louisiana, Illinois, Mississippi, Michigan, South Dakota, Oklahoma, Nebraska, Colorado, Arizona, Ohio, and New York) and a third of all cases were reported from Texas.

Table 4

Michigan Human WNV

Year	Total Cases	Fatalities
2012	229	14
2011	33	2
2010	29	3
2009	0	0
2008	17	0
2007	13	2
2006	55	7
2005	62	4
2004	16	0
2003	19	2
2002	614	51

Figure 7



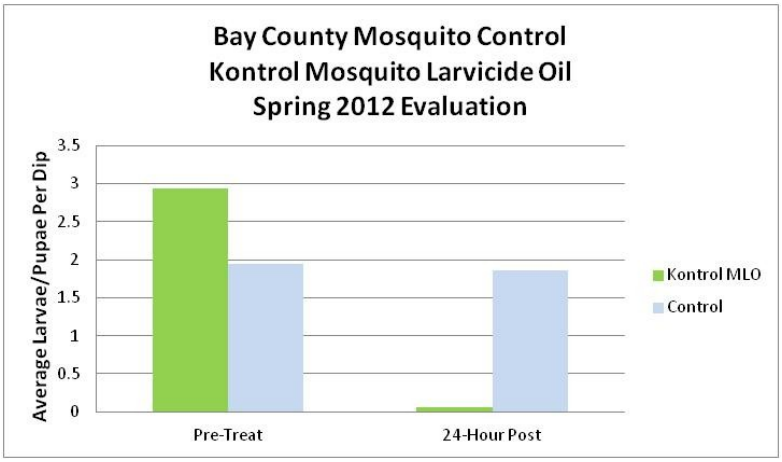
Product Evaluations

An evaluation of MasterLine® Kontrol Mosquito Larvicide Oil was conducted to monitor efficacy under field conditions in a rural area of Bay County. First we looked at its impact on the larval and pupal density of spring mosquito species (*Aedes canadensis*) in a flooded woodlot habitat.

Using a dosage rate of 1 gallon per acre, the Kontrol MLO was applied using a pressure sprayer with 10 pools monitored in the treatment zone and another 5 pools left as untreated controls. Precounts were taken just before the application followed by a 24-hour post-count with averages reflected in the figure below. Water temperatures at treatment time averaged 46.2° F. Twenty-four hours later when post-counts were taken, water temperatures averaged 64.8° F. The Kontrol MLO spread well and covered the water surface, even under cooler conditions. At the 24-hour post-count, live chaoborid larvae, water mites, chironomid larvae and scuds were observed. No rain fell during the treatment period.

Overall, an average 94.8% mosquito mortality was detected in the treated pools while control pools averaged 4.6%. Kontrol MLO worked well in the seasonally flooded woodland habitat.

Figure 8



A second trial of Kontrol MLO that took place in August in a floodplain habitat breeding *Aedes vexans* occurred under much warmer conditions (average water temp. was 75° F). After 24 hours, the average mortality was 74% and that number dropped at the 48-hour mark to 63%. Much more surface vegetation was present in the floodplain than in the spring woodlot, which may have led to the lower control level. The product is labeled at rates of one to five gallons per acre and we applied at two gallons per acre. The oil did not work well at this rate considering the heavy vegetation. In the spring when vegetation is essentially absent, the product worked well. This may be a product that would be better suited to the spring habitat.

Product Evaluations, continued

Another evaluation of a mosquito larvicide oil was conducted as we looked at the effectiveness of CocoBear™ Larvicidal Oil. The trial took place in mid-August with 10 treatment habitats and 3 untreated controls monitored. The treated sites included flooded fields, roadside ditches, floodplains, and flooded woodlots that were utilized by *Aedes vexans*. The recommended dosage rate of the product was 3-5 gallons per acre and we used the lower rate. Mortality of third instar larvae, fourth instar larvae, and pupae after 24 hours, was 100% in all pools while controls averaged 14%.

The effectiveness of the product to control mosquitoes was superb; however, there was one issue with the product—it killed grass where it was applied. We noticed the grass turned black after 24 hours and eventually yellow after 1-2 days. Of note, frogs, copepods and isopods present in the pools were still present in equal densities after application. This is a product we will not be using until the herbicidal properties are resolved.

Lastly, a preliminary caged mosquito test was performed to look at the level of control offered by AllPro® Envion RTU 4-4 (permethrin) adulticide under field conditions at a rate of 4.7 ounces per minute. Approximately 30 mosquitoes were placed in cages at distances of 75' and 150' downwind from a truck-mounted ULV treatment. Mosquitoes were collected from several areas and included the following species: *Aedes vexans*, *Ae. trivittatus*, *Psorophora ferox*, and *Ae. stimulans/fitchii*. The average 24-hour mortality in the 75' cages was 97% with 63% seen in the 150' cages; untreated control cages averaged 2% mortality. On several occasions, night-time technicians and supervisors noticed quick knockdown of adult mosquitoes after fogging with Envion in response to bothersome levels of adults.

Resistance

When insecticides repeatedly fail to achieve an expected level of control when used according to label recommendations, mosquitoes are said to have become resistant to the particular material. Resistance, therefore, is always a concern, so the program relies on using biological insecticides and various chemicals in a variety of habitats and against different developmental stages throughout the season to help reduce the chances resistance will become a problem. In order to monitor for mosquito resistance to control materials, bottle bioassays are run which expose a number of adult mosquitoes to a given amount of insecticide. This resistance testing is a continuous part of the program and this year Kontrol 4-4 adulticide was used with over 80% mortality after 15 minutes and 100%mortality achieved after 45 minutes. This is comparable to previous years.

Weather

Weather plays an important role in mosquito control—details for 2012 are included here. The winter months will be remembered as having been warmer than average with snowfall close to normal; however, the persistent warmth allowed for little snowpack as the snows seemed to melt as fast as they fell. March brought with it an unprecedented early-season heat wave with average temperatures 14 degrees above normal. From March 14-20, six new daily high temperature records were set. Interestingly, the month of April was colder than the month of March, which has little to do with an average April and much more to do with the March 2012 heat wave! An unusually warm May rounded out a record spring for the Great Lakes Bay Region.

June was characterized as warmer-than-normal, but dry, as the mosquito season started out on a slow pace. July brought with it record heat and drought. Although July rains were above-average, the rains came during thunderstorms, which were ineffective at alleviating drought conditions. Overall, the summer was characterized by record warmth and drought; however, one major rain event brought a period of extraordinary rainfall, with some rain gauges topping 7-8". Monitor and Bangor Townships were hit exceptionally hard with ditches filled to the brims and front and side yards completely flooded along Midland Road (photo below). So what had been a slow mosquito season quickly escalated with huge mosquito populations emerging on August 24 about two weeks after the heavy rains.

Drier, cooler weather prevailed in September, which allowed us to confidently shut down operations at the end of the month.

Figure 9 (page 25) shows the average rainfall amounts that were measured in rain gauges placed throughout the county. Rain events that drop over an inch of rain are typically sufficient to cause a new hatch of mosquitoes. There was really only one such rain event that occurred during summer 2012 and that was the August rain.

Table 5 (page 25) lists weather data occurring in Bay County during Nov-Dec, 2011 and Jan-Oct, 2012.

Midland Road between Seven Mile and Fraser

Figure 9

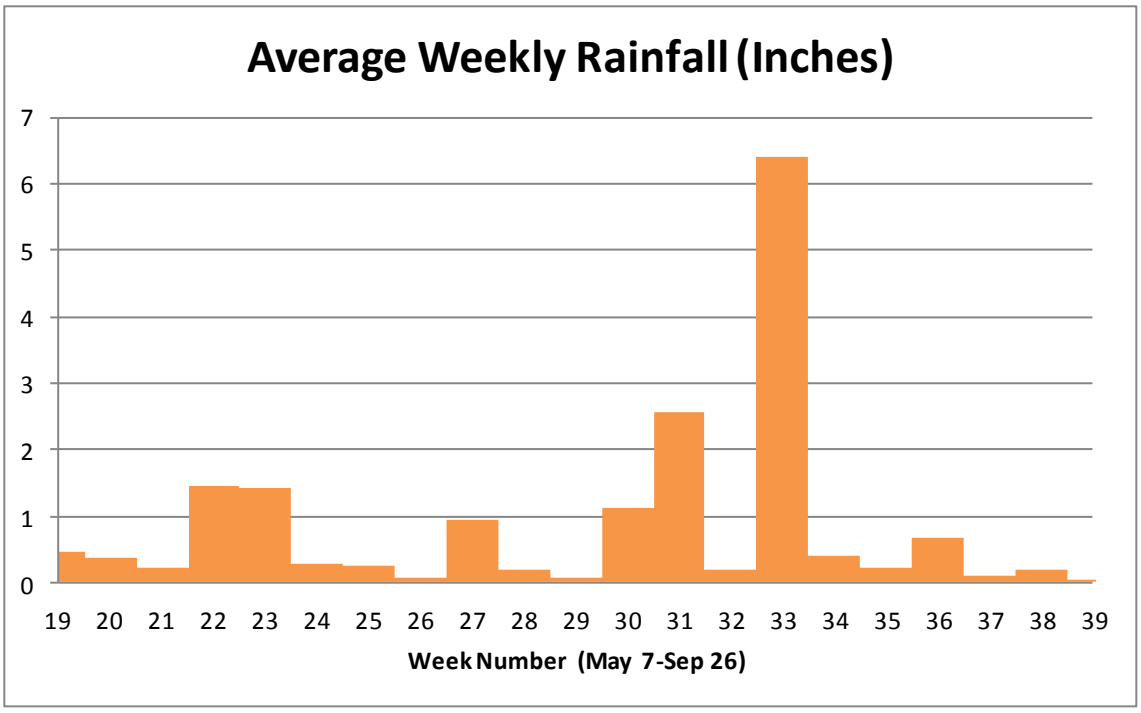


Table 5

Month	Normal Rainfall	2011/2012 Rainfall	Departure from Normal	Normal Average Mean Temp.	2011/2012 Average Mean Temp.	Departure from Normal
November	2.7”	2.06”	- 0.64”	38.5°	43.1°	+4.6°
December	1.86”	1.25”	-0.61”	27.3°	33°	+5.7°
January	1.71”	1.77”	+0.06”	22.2°	28.4°	+6.2°
February	1.61”	1.53”	-0.08”	24.5°	30.3°	+5.8°
March	2.06”	2.02”	-0.04”	33.7°	48°	+14.3°
April	2.89”	1.66”	-1.23”	46.1°	46.9°	+0.8°
May	3.38”	2.35”	-1.03”	57.3°	62.8°	+5.5°
June	2.98”	2.02”	-0.96”	67.2°	70.8°	+3.6°
July	2.58”	4.9”	+2.32”	71°	76.7°	+5.7°
August	3.31”	7.24”	+3.93”	68.8°	70.8°	+2°
September	3.83”	1.03”	-2.8”	61.3°	62.3°	+1°
October	2.63”	3.36”	+0.73”	49.7°	50.9°	+1.2°

Spring Aerial Campaign

Spring 2012 was strange, to put it mildly. The mosquito control season, which typically begins in April with aerial larviciding to control spring woodland mosquitoes, began on March 25. This is the earliest date in BCMC's history and is a full two weeks ahead of normal. It all stemmed from the heat wave of March which helped accelerate larval growth compared to what is customary. The operation targets vulnerable larvae before they reach the adult, biting stage. The aerial program has gone on for over three decades in the Saginaw Valley and remains the best way to dramatically decrease numbers of spring *Aedes* mosquitoes. The preferred control method uses a bacterial product known as *Bti* (*Bacillus thuringiensis israelensis*) to control their larvae.

Earl's Spray Service, Inc. of Wheeler, Michigan used two aircraft to apply *Bti* to 41,600 woodland acres in the following townships: Beaver (6,400 acres), Fraser (4,200 acres), Garfield (6,675 acres), Gibson (1,400 acres), Kawkawlin (3,200 acres), Mt. Forest (8,425 acres), Pinconning (7,300 acres), and Williams (4,000 acres). Clarke of Roselle, Illinois utilized one Jet Ranger helicopter to apply *Bti* to 7,803.2 acres in the following townships: Bangor (2,773.8 acres), Frankenlust (768 acres), Hampton, Portsmouth, Merritt, and Bay City East (948 acres), Mt. Forest (2,016 acres), and Monitor (1,297.4 acres).

Calibration, loading, and fueling of the fixed wing aircraft took place at Barstow Airport in Midland while a variety of loading and fueling sites throughout the county were used for the helicopter in order to decrease ferry time. Sites were treated with VectoBac® *G Bti* corncob granules at a dosage rate of four pounds per acre (fixed wing) and five pounds per acre (helicopter).

1300-pound bags of *Bti* used in the fixed-wing operation

Spring Ground Surveillance/Larviciding

Four certified technicians helped with aerial quality control, conducting post-treatment surveys in 75 woodlots to assess *Bti* application. After the completion of the aerial treatment program, these same technicians were the first to begin inspections and subsequent ground treatment using primarily *Bti* and BVA2 larvicide oil to manage the larvae or pupae. Field technicians began to treat woodland pools with larvicide oils, concentrating on smaller woodlots not feasibly treated by aircraft.

Technician Matt Mikolajczak dips for early spring larvae

Table 6

Table 6 lists the number of acres treated by foot crews and material used in smaller tracts of woodlots during the 2012 spring season. Almost 250 acres received larval treatment by ground crews to control the emergence of the pestiferous spring *Aedes* mosquito. The crews checked 291 sites, dipping each one, to determine the need for treatment. A total of 181 sites were treated; 43 were dry, while some were wet, but not breeding. A total of 32.8 pounds of *Bti* and 235.83 gallons of BVA-2 larvicide oil were dispensed at a dosage rate of 5 pounds/acre and 1 gallon/acre, respectively. Pupae, which are usually noted between May 2-6, were found as early as April 7 and significant emergence of spring *Aedes* adults occurred between April 14-21, a full three weeks before the typical dates of May 9-15. This would have initiated adulticiding, control of adult mosquitoes through fogging operations, had the weather been warmer. As it was, virtually no complaint calls were logged due to a cold spell in April that most likely killed many adult mosquitoes.

Spring Ground Treatment

Township	Acres Treated	BVA2 (gal)	Bti (lb)
Bay City East	0.25	0.25	
Bay City West	6.58	6.58	
Bangor	4.42	4.42	
Essexville	0.13	0.13	
Frankenlust	5.16	5.16	
Fraser	12.66	12.66	
Garfield	60.57	60.57	
Gibson	21.16	21.16	
Hampton	16.51	9.95	32.8
Kawkawlin	3.03	3.03	
Merritt	0.5	0.5	
Monitor	5.67	5.67	
Mt. Forest	78.59	78.59	
Pinconning	24.46	24.46	
Portsmouth	0.5	0.5	
Williams	2.2	2.2	
Total	**242.39**	**235.83**	**32.8**

Summer Larviciding

Bay County residents enjoy spending time outdoors during summertime, but the presence of mosquitoes can interfere with outdoor recreation. We try hard, therefore, to reduce mosquito numbers so residents can enjoy Michigan's all-too-short summer while also reducing vector mosquitoes.

Our comprehensive mosquito control program focuses on routine surveillance and control of potential breeding sites to prevent adults from emerging. The program involves MDARD-certified technicians applying insecticides to stagnant water throughout the county. During the breeding season, a team of 21 technicians inspect water habitats guided by a database of known breeding sites, citizen complaints, and high trap numbers. Homeowners are notified of property inspections either in person or through the use of a door hanger.

Efforts directed at larval control are accomplished by using bacterial, chemical, or sanitary (dumping water from containers) methods. The district uses several natural bacterial products for control of larval mosquitoes. These include VectoBac®G (*Bti*), *Bti* Briquets™, VectoLex® CG (*Bacillus sphaericus*) and Natular® XRT and 2EC (*Saccharopolyspora spinosa*). Chemical insecticides routinely used include temephos (Allpro® ProVect 1G and Abate® 4-E), alcohol-based monomolecular surface films (Agnique® MMF and Agnique® MMFG WSP) and petroleum-based oil (BVA2). The Agnique MMF was used near the Lake Huron beachfront as well as sensitive wetland areas.

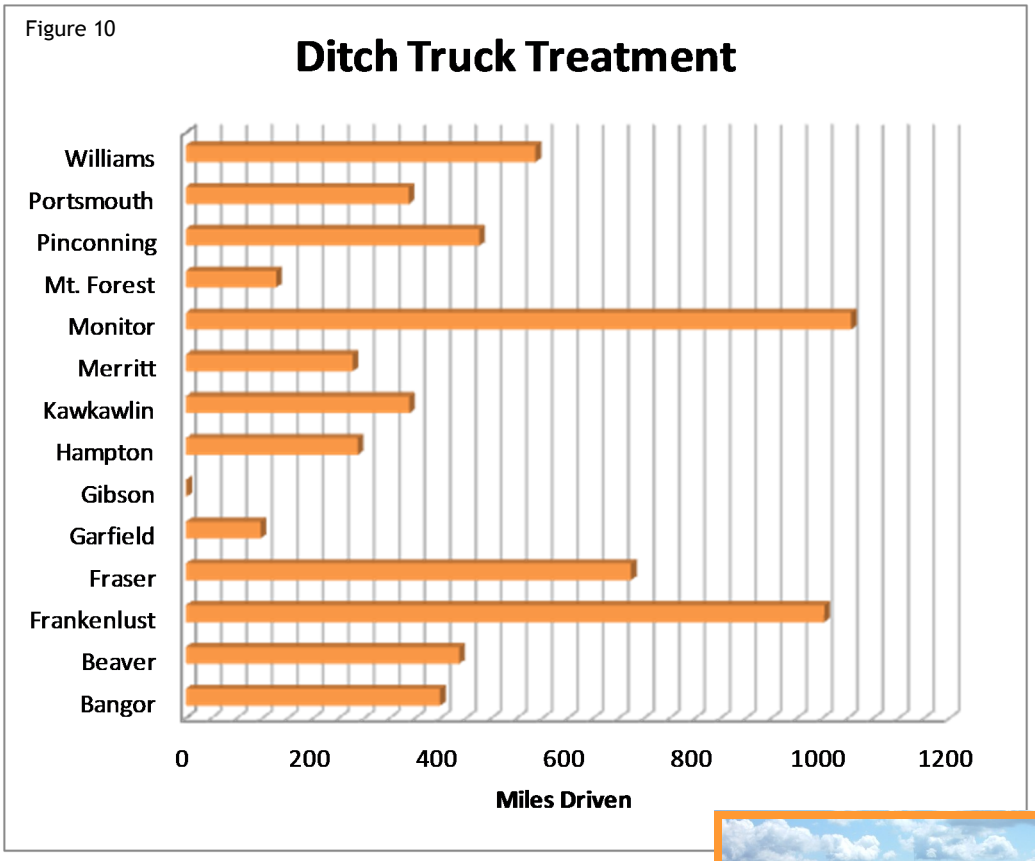
Larval Sites: The total number of breeding sites changes each year as new sites are added to the database and others are deleted. A total of 26,136 larval site inspections were conducted this season (a 34% increase over last year), which is most likely due to drought-like conditions—fewer sites were treated so more time was devoted to searching. Only 12% (3,146) of those were actually treated with a larvicide material. This percentage treated was lower than the previous years' 16-17%. Some of these sites were permanent breeding habitats while others were temporary and included ditches, containers, fields, woodlots, tires, idle pools, ornamental ponds, and Saginaw Bay beachfront. Larvae are sampled by quickly skimming the water's surface with a dipper; some are collected and returned to the lab for identification. Technicians also control mosquitoes by dumping water from buckets, pails and other man-made containers (one method of source reduction) on a regular basis. This is the preferred method to eliminate mosquitoes from breeding in containers.

Events: In addition to surveillance and control in neighborhoods throughout the county, special attention is given to summertime outdoor recreational events, such as the Auburn Cornfest, Munger Potato Festival, and River of Time, to name a few. According to the Bay Area Convention and Visitors Bureau, over a half million people attend these types of festivals. Controlling larvae prevents adults from emerging and interfering with outdoor recreational activities.

Ditch Treatments: Bay County's topography is very flat and most roadways are flanked by ditches, which divert water from the county's 1,400 linear miles of roads. In addition, ditches serve as breeding grounds for mosquitoes, so much attention is given to monitoring their mosquito activity. In fact, surveys are made by lab personnel once each week. Most problems with breeding occur after major rainfall events, which stimulate mosquito eggs to hatch.

This year, ditch trucks logged 6,084.1 miles driven, which was 15% less than the 2011 treatment season, dispensing 2,467.2 gallons of Abate 4E mix (13.5 gallons of Abate 4E) and 917.3 gal of Natular 2E mix (6.02 gal Natular 2E). Figure 10 shows in which townships the ditch trucks treated the most miles. Ditch trucks logged 2,049.2 miles in Monitor and Frankenlust Townships combined. The ditches in those two areas were found breeding mosquito larvae more often, a reflection of the rainfall events within both townships.

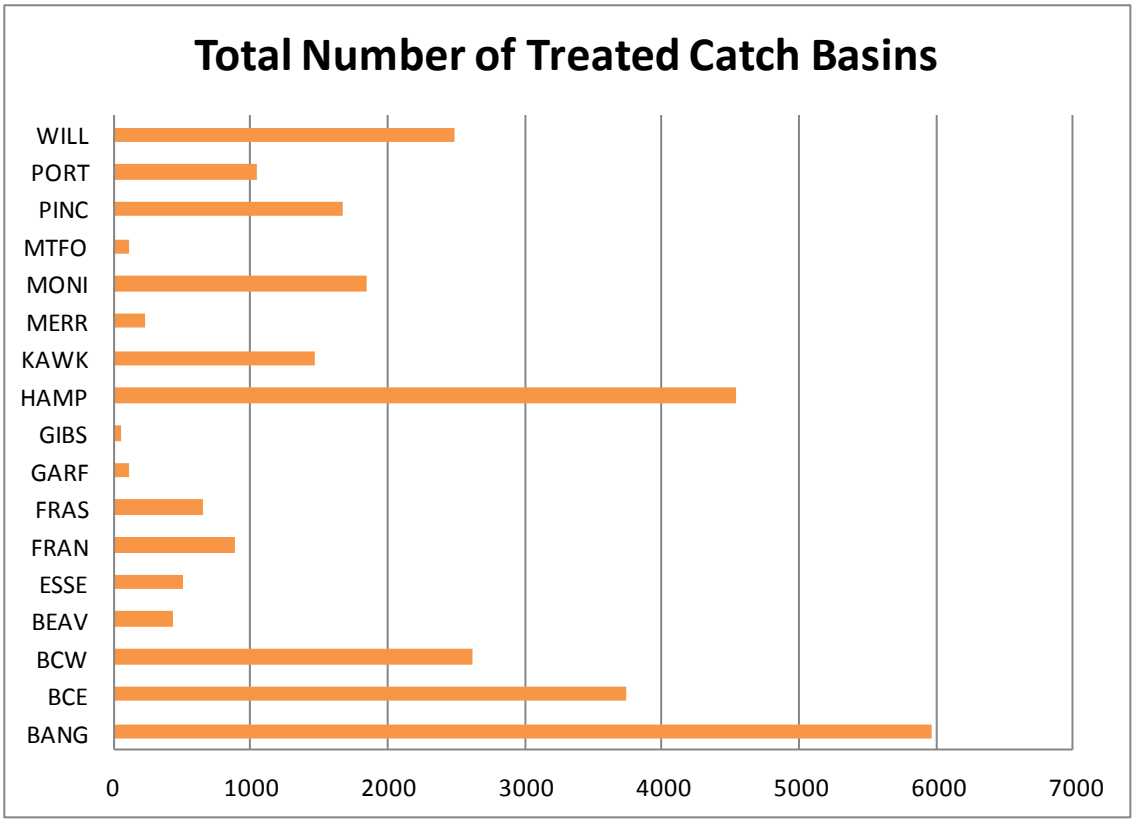
Figure 10



Catch Basins: Treatment of catch basins will control *Culex restuans* and *Culex pipiens* mosquitoes, known vectors of both St. Louis encephalitis and West Nile virus. These species are not considered nuisance mosquitoes, as they feed primarily on birds; however, controlling disease vectors is extremely important in our efforts to decrease disease potential and maintain public health. Staff monitored mosquito breeding in catch basins and treated a total of 28,382 individual habitats. Figure 11 shows the number of catch basins treated in each township or city. The bulk of treatment took place in Bay City, Bangor Township, Hampton Township, and Monitor Township, the most urban areas of the county.

Mainly, catch basins were treated using either Natular® XRT (9,724 individual tablets) or VectoLex® CG bacterial larvicide (471.24 pounds). In addition, 60 basins were treated with either Four Star 45-day or 180-day material while 0.27 gallons of BVA2 oil was dispensed in catch basins that harbored mosquito pupae. Basins treated with VectoLex were treated multiple times, depending on when larval surveillance showed that control had ceased. Treatments began in mid-May with the last VectoLex treatment occurring in early September.

Figure 11



Retention Ponds: Bay County is home to 126 retention ponds that are designed to hold storm water until the water either percolates or evaporates, which returns the area to its normally dry state.

Floodwater mosquitoes are usually the first to appear in retention ponds, but *Culex* and *Anopheles* mosquitoes can also be found. Certified technicians surveyed retention ponds, making 917 individual visits throughout the summer. Of those 917 surveys, no treatment was needed 80% of the time, which is essentially the same trend seen in the search and destroy operation. However, on the days when treatment was necessary, the following larvicides were used to control either larvae or pupae: *Bti* Briquets (54.5), *Bti G* (680.16 lb), BVA2 (17.8 gal), Agnique MMF (94.81 oz), and VectoLex CG (0.56 lb).

When conducting surveys and/or larviciding of retention ponds, technicians utilized aerial maps that detailed the location and size of each pond. This gave technicians a way to quickly locate the ponds allowing for more efficient surveillance and treatment.

Sewage Lagoons: Sewage lagoons are perfect breeding zones for *Culex* mosquitoes as they are filled with polluted, highly organic water all summer long. Two sewage lagoons were monitored this season—White Birch Village and Pinconning McDonalds—resulting in 28 treatments, 89% of which were done at White Birch Village. In order to treat sewage lagoons, a Michigan DEQ Water Treatment Additive form was first approved. The following products were dispensed: 30 *Bti* Briquets, 49.65 gallons of Abate 4E mix (0.2 gal Abate 4E), and 18.69 gal of BVA2.

Search and Destroy: Besides the larviciding activities previously discussed (ditch trucks, sewage lagoons, retention ponds, and catch basins), technicians also spent most days engaged in what is known as Search and Destroy. This simply means that technicians search for and control immature mosquitoes in various breeding habitats, most of which are shown in the table below.

Table 7

HABITATS		
Artificial Containers	Catch Basins (Wild)	Cross Country Drains
Flood Plains	Flooded Fields	Flooded Woodlots
Idle Pools	Ornamental Pools	Ponds
Rain Barrels	Roadside Ditches	Tires

It is important to select the appropriate control material and formulation based on what mosquito life stage is encountered in the water habitat. Timing of the application is also crucial as is the amount of product applied. As technicians search for mosquito breeding, they also educate Bay County citizens about how to prevent mosquitoes from breeding in containers around residents' backyards. Technicians leave door hangers when they encounter tires, reminding citizens about the residential scrap tire drives and the need to recycle tires in order to prevent mosquitoes from breeding there.

Table 8 illustrates the control materials dispensed during Search and Destroy activities.

Table 8

Search and Destroy Operations	
Control Material	**Amount Dispensed**
Abate 4E	106.5 gal of mix
Agnique MMF Paks	9
Agnique MMF	5.5 gal
Bti	2,015.9 lb
BVA2	527.7 gal
Bti Briquets	794
Natular 2E	18.5 gal of mix
ProVect 1%	1067 lb
VectoLex	6.65 lb

Adulticiding

While larval control is the preferred method of treatment, it is virtually impossible to find and treat all breeding sites, so adulticiding (fogging to kill adult mosquitoes in flight) is also carried out to control mosquitoes. Mosquito numbers vary between seasons and years and a major contributing factor to this is the amount of rainfall received. While it is not possible to eliminate mosquitoes, it is important to take measures to reduce the risk of being bitten by nuisance or infected mosquitoes. Adult mosquito activity will increase following periods of heavy rains that cause new mosquito broods to hatch. Fogging adult mosquitoes includes the use of Ultra Low Volume (ULV) equipment that allows a relatively small amount of material to be dispensed from the spray equipment. Application rates are adhered to by using GPS units with SmartFlow technology in each truck. Label recommendations are strictly followed to assure proper dosage rates and droplet sizes during adulticide applications. To accomplish the latter, droplet measurements are taken several times throughout the season. The first droplet characterization session took place in early May with Rob Cascioli (Clarke) using the AIMS (Army Insecticide Measuring System) to measure aerosol droplets; software was utilized to store electronic files. Subsequent checks of droplet sizes took place using the Teflon® slide method.

When weather conditions are conducive to fogging (temperatures above 50°F and winds below 10 mph), eight certified technicians fog cities and townships that have either the highest mosquito populations or noted disease activity. This year saw the routine use of the permethrin products Masterline® Kontrol 4-4 and Biomist® 4+4 ULV. Mosquitoes must come in contact with the droplets in order for the insecticide to be effective so adulticiding activities take place after sunset when most mosquito species are active and bees have returned to their hives.

For management purposes, Bay County utilizes route maps during adulticiding operations. These road maps of each township show the most efficient route to follow when adulticiding so all roads are treated and no roads are re-treated or missed during a nightly operation. The maps also highlight addresses of medical and no spray residences. Medical residences (of which there are 56) are homes that qualify to be a part of our Medical Needs Program because at least one resident is allergic to mosquito bites or has verifiable medical needs. The medical condition must be confirmed by a medical doctor. No spray residences are homes that prefer not to be treated for mosquitoes; there are 97 such addresses.

Adulticiding Treatment

Table 9

Township	Kontrol 4-4 (gal)	Biomist 4 + 4 (gal)	Envion 4-4 (gal)	Miles Treated
BANG	512.69	0.87	1.82	2251.6
BCE	130.99	0.1	12.83	626.42
BCW	106.9	0	3.43	503.52
BEAV	121.36	43.9	0.25	800.47
ESSE	25.34	0.31	0	113
FRAN	158.42	0.17	17.61	806.7
FRAS	153.04	43.33	8.71	943.32
GARF	115	67.85	0	835.42
GIBS	107.4	78.49	0.22	906.46
HAMP	350.58	0	0.87	1575.03
KAWK	250.03	0.3	1.78	1191.03
MERR	136.61	0	0.47	642.05
MONI	546.67	0	8.89	2514.12
MTFO	124.7	78.2	0	972.21
PINC	156.67	72.8	5.05	1097.13
PORT	167.21	3.98	0.18	808.74
WILL	300.09	0	6.84	1442.01
TOTAL	**3463.7**	**390.3**	**68.95**	**18029.23**

During the 2012 season, the "Long Driveway Program" continued. This program is designed to fog inhabited properties that sit a considerable distance off the main road and that do not receive adequate adult mosquito control during normal fogging operations. Eighty-one such addresses were placed on route maps to be fogged on a regular basis, an increase of 20% from 2011.

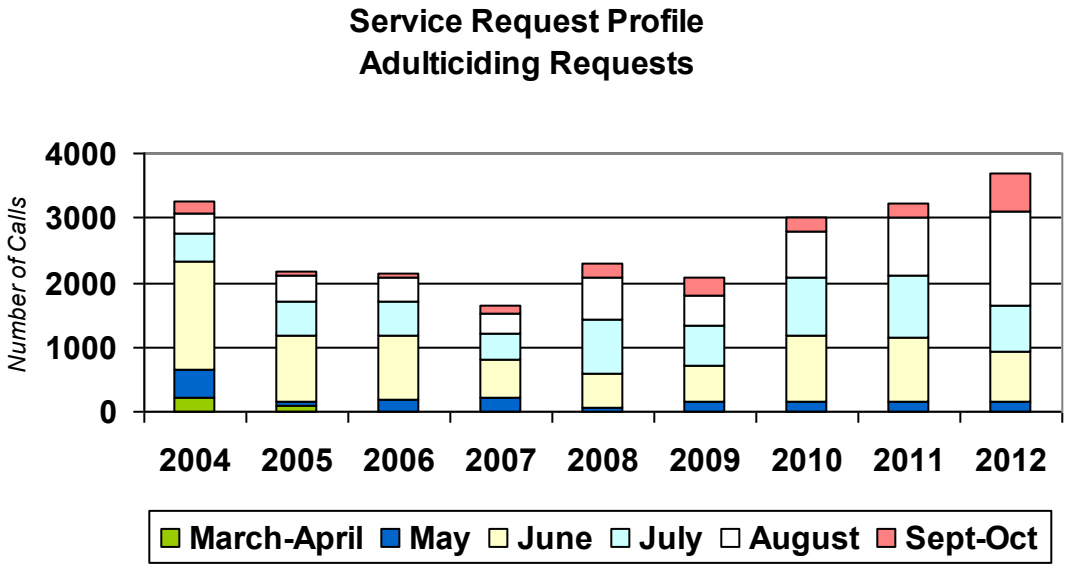
Table 9 reveals that 18,029.23 miles were logged during adulticiding operations and 3,922.95 gallons of adulticide were dispensed, with the majority being Masterline Kontrol 4-4 (3,463.7 gallons). Compared to 2011, this is 461 fewer gallons of control materials and 8% fewer miles treated.

Customer Calls

Traps are the primary indicator of mosquito activity, but customer calls are also used as a means to indicate where adult populations are problematic. Office staff answered and technicians responded to 3,698 adult mosquito service requests received from Bay County citizens. Most (2,940) of the calls were regular service requests for adulticide treatment due to nuisance mosquitoes and most of those calls were logged August 27-September 7. An additional 758 calls represented special event spray requests. In comparison to 2011, the level of adulticide service requests increased by 14%. Most of the calls were received in August (1,452) with calls peaking two weeks after the major August rain event.

Three hundred forty-seven calls were also received reporting standing water with potential mosquito breeding, with an additional 138 larviciding calls logged into the system that accompanied an adulticide event request. Regardless of the type of service request, all were responded to in a professional, courteous, and prompt fashion. Figure 12 represents a historical profile of adulticide requests.

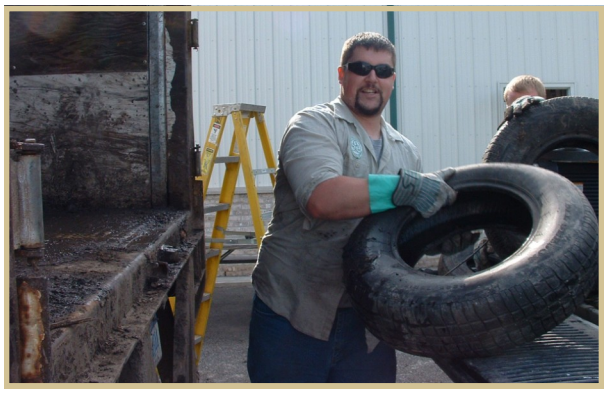
Figure 12



Scrap Tire Drives

Scrap tire drives are one method of source reduction, the removal or elimination of breeding sources that currently are or have the potential to breed mosquitoes. Two community tire drives were held this season—one in the Spring and one in the Fall with 3,546 tires collected—17% less than was collected in 2011.

Semi-trailers are filled at our field station or other satellite locations such as Pinconning County Park, where county residents are able to bring tires to our spring tire drive. Trailers are then hauled back to Environmental Rubber Recycling where tires are recycled at the Flint facility. Tires are ground into chips and shipped to Michigan power plants to be burned as tire-derived fuel (TDF).



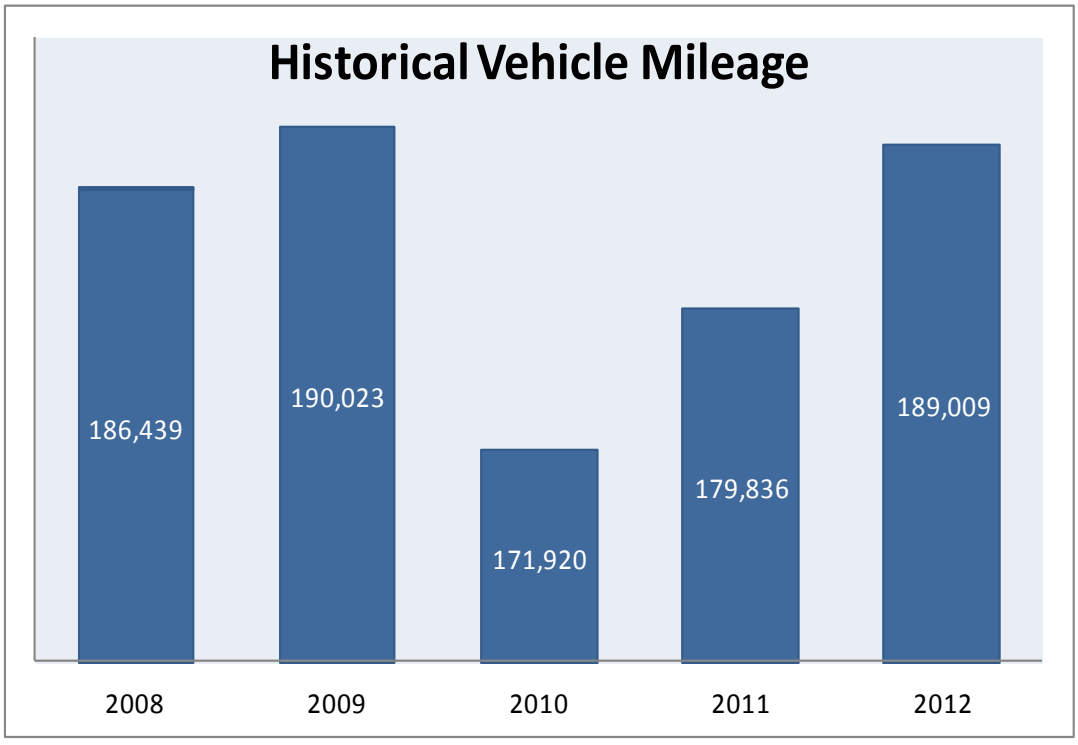
Vehicle Maintenance/Mileage

Bay County Mosquito Control's state-certified mechanic maintains the 33-vehicle fleet as well as four Bay County Animal Control vehicles, which are billed for parts and labor. Besides vehicles, the shop maintains forklifts, ULV foggers, ditch truck sprayers, and various types of equipment. From time to time, specialized equipment is designed and fabricated.

During the 2012 season, as Figure 13 shows, 189,009 miles were driven, which is just shy of the 20-year average of 191,506 miles and represents 5% more miles than were driven in 2011. Vehicle maintenance repairs included the following: brake systems (24), fuel systems (12), front end repairs (16), truck oil changes (70), electrical systems (51), drive lines (7), new tires (24), and used tire repair (10).

In addition to maintaining the vehicles, the mechanic was responsible for repairing and maintaining equipment used by mosquito control staff. Equipment repairs included: ULV oil changes (45), ULV repairs (30), ditch truck repairs (42), Hudson® pressure sprayer repairs (16), spreader repairs (7), CDC Trap repairs (8), New Jersey Light Trap repairs (3), and Gravid Traps (7).

Figure 13



Storm Water Pollution Prevention Plan

To comply with state and federal regulations on storm water runoff from urban and suburban areas, many communities have implemented new programs to reduce the adverse impact of storm water runoff on streams, rivers, lakes, and estuaries. Compliance at BCMC is achieved by following a Storm Water Pollution Prevention Plan (SWPPP) that began in July of 2010.

According to permit guidelines, in addition to routine monthly inspections, comprehensive inspections are completed once every six months by a certified storm water operator. The overall objective is to ensure continued use of Best Management Practices (BMPs) and good housekeeping practices as defined by the MDNR. Any leaks, spills or other exposure of significant materials shall be addressed immediately to achieve compliance with permit standards. Additionally, it is imperative to identify any potential sources of storm water contamination and reduce that potential by the greatest extent possible.

The areas inspected in 2012 included the chemical storage, cold storage, wash bay, garage, and parking lot. There were also four indoor and three outdoor catch basins monitored. Minor vehicle leaks were the main issue observed during inspections. These were cleaned up with either Floor-Dry granular absorbent or soap, water, and paper towel.

NPDES

The Michigan Department of Environmental Quality has issued Bay County Mosquito Control a Certificate of Coverage (COC) under the National Pollution Discharge Elimination System (NPDES) General Permit No. MIG030000. The COC authorizes CMC to discharge biological pesticides and pesticide residues resulting from the application of chemical pesticides to control mosquito and other flying insect pests, in, over, or near to surface waters of the State of Michigan. The permit expires February 1, 2017.

Education

Efforts are made to inform and educate Bay County residents about mosquito control methods and mosquito-borne diseases. A great deal of education takes place every day through hundreds of personal contacts in the field and calls to the office. Periodic interviews by newspaper, television, and radio allows discussion of news affecting the public, such as spring aerial treatment, summer programs, homeowner property inspections for water elimination, West Nile encephalitis, and scrap tire drives. Staff training is also held on a regular basis to update staff on various topics including safety, disease activity, and policies and procedures.

Presentations are also given to various groups, including school-based programs. Brochures and handouts are developed and distributed at various locations and our website (www.baycounty-mi-gov/MosquitoControl) is updated regularly.

Membership/Certification

Membership in professional organizations remains vital in accessing updated and new information and maintaining good working relationships with peers. Membership with the non-profit Michigan Mosquito Control Association (MMCA), American Mosquito Control Association (AMCA), and The Entomological Society of America (ESA) are maintained. All are beneficial due to conferences, publications, networking, and legislative advocacy.

All staff members maintain certification with the Michigan Department of Agriculture and Rural Development (MDARD) in both the Core and 7F (Mosquito Control) categories. Two training sessions were held April 27 and June 4 with 34 new and returning technicians in attendance. Staff also attended MMCA's 25th annual meeting in Troy, Michigan in February and the MMCA 2012 Mosquito Control Training Session in October in Bay City, both of which offered continuing education credits.

BCMC's program plan was reviewed and approved in January by the MDARD as part of our Comprehensive Community Outreach as mandated in Regulation 637.

Staff attended the Technical Advisory Committee (TAC) annual meeting in March 2012 where the 2011 annual report and 2012 program plan were presented for review and approval.

Table 10

2012 Insecticide Use Summary			
Trade Name	**Application Rate**	**Active Ingredient Dosage**	**Amount Used**
Temephos 1%	10 lbs/acre	0.1 lb temephos/acre	1007.2 lb
Abate® 4E concentrate	1.5 fl oz/acre	0.0468 lb temephos/acre	14.9 gal
Bactimos Bti Briquets™	1/100 square feet	7000 AA (Aedes aegypti) Bti ITU/mg	1073.5 briquets
VectoBac® G	5 lbs/acre	0.4555 billion Bti ITU/acre	208,580.9 lb
Agnique® MMF-G Pak 35	1/160-350 square feet	2.24-6.88 lb alcohol-based surface film/acre	29 ea
Agnique® MMF	0.2—1.0 gal/acre	0.2—1.0 gal alcohol-based surface film/acre	17.74 gal
All Pro® Envion 4-4	0.78 fl oz/acre	0.00175 lb permethrin/acre 0.00175 lb PBO/acre	55 gal
BVA2 Mosquito Larvicide Oil	1—5 gal/acre	0.987-2.96 gal petroleum distillates/acre	624 gal
VectoLex® CG	5-80 lbs/acre	0.115-1.84 billion BsITU/acre	510.02 lb
Masterline® Kontrol 4-4	0.676 fl oz/acre	0.00176 lb permethrin/acre 0.00176 lb PBO/acre	3401gal
Biomist® 4 + 4 ULV	0.75 fl oz/acre	0.00175 lb permethrin/acre 0.00175 lb PBO/acre	325 gal
Natular™ XRT	1 XRT tablet/catch basin	6.25% spinosad/tablet	9,900 tablets
Natular™ 2EC	1.1-2.8 fl oz/acre	0.017-0.044 lb spinosad/acre	37.125 gal

Map of Bay County, Michigan